Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Effect of Material Property Variations at Near Critical Thermodynamic Conditions on Pipe Flow Heat Transfer[1] REBECCA BARNEY, University of California, Davis; Lawrence Livermore National Laboratory, ROBERT NOURGALIEV, Lawrence Livermore National Laboratory, JEAN-PIERRE DELPLANQUE, University of California, Davis, ROSE MCCALLEN, Lawrence Livermore National Laboratory — Heat transfer is quantified and contrasted for the Poiseuille flow of a fluid at both subcritical and supercritical thermodynamic conditions in a circular pipe subject to a uniform wall heat flux. The conditions considered are relevant to Supercritical Water Reactor (SCWR) applications. In the supercritical thermodynamic regime, a fluid can exhibit large density variations of density, thermal conductivity, and viscosity, which will affect flow and heat transfer characteristics significantly. An advanced equation of state for supercritical water was implemented in a 2D and 3D Arbitrary Lagrangian-Eurlerian multi-physics simulation tool called ALE3D developed at Lawrence Livermore National Laboratory. A newly developed, robust, high-order in space and time, fully implicit reconstructed discontinuous Galerkin (rDG) method is used to enable the numerical simulation of convective heat transfer with supercritical water. Results demonstrate the capability of this approach to accurately capture the non-linear behavior and enhanced heat transfer with supercritical water. Work is supported by the Integrated University Program Graduate Fellowship. Opinions, findings, conclusions or recommendations expressed are of the authors and do not necessarily reflect the views of DOE office of NE

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. Information management release number LLNL-ABS-736004.

Rebecca Barney
University of California, Davis

Date submitted: 01 Aug 2017 Electronic form version 1.4